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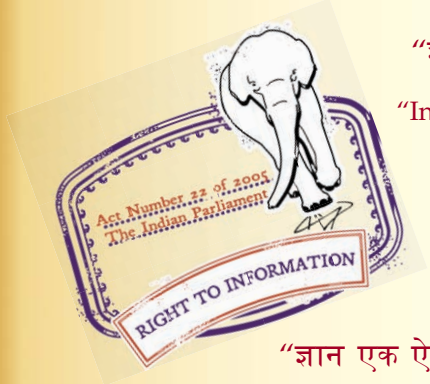

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"Knowledge is such a treasure which cannot be stolen"

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Indian Standard

(Reaffirmed 2006)

GLOSSARY OF TERMS RELATING TO METAL FORMING MACHINES AND TOOLS

PART 3 METAL FORMING TECHNOLOGY AND OPERATIONS RELATING TO SHEET METAL

(First Revision)

[Ref : Doc : EDC 72 (3822)]
Metal Forming Machines and Tools Sectional Committee, EDC 72

1. Scope — Covers the definitions of terms relating to metal forming technology and operations in sheet metal working.

2. Definitions

A

2.1 *Air Bending* — Bending operation in which work contacts the tools at only three points.

2.2 *Assembling* — An operation of fastening two or more parts together by press fitting, seaming, curling, riveting, etc, in a press tool.

B

2.3 *Beading* — Forming a narrow ridge in a sheet metal workpiece or part, commonly formed for reinforcement.

2.4 *Bend Allowance* — The developed length of curved portion between its extremities measured along the neutral axis.

2.5 *Bend Angle* — An angle through which a bend is performed.

2.6 *Bending* — An operation in which the workpiece forms an angle about a straight line axis on the workpiece itself.

2.7 *Bevel* — Difference between 90° and bend angle of a flange.

2.8 *Blank* — A pre-cut metal shape ready for subsequent press operations.

2.9 *Blanking* — Cutting closed contours or shapes called blanks out of sheet or strip stock.

2.10 *Blister* — A metal defect, originating either from blow holes in the ingot or form a damaging treatment, such as over-heating or corrosion.

2.11 *Bottoming* — Squeezing the workpiece at the bottom of stroke to obtain desired form with no intentional change in thickness.

2.12 *Bulging* — The process of circumferential expansion of outer walls of any hollow shape.

2.13 *Burnishing* — Polishing or brightening a metal surface by sliding or rolling a smooth surfaced tool under pressure over the surface.

2.14 *Burr* — The defect in a blanked/pierced component in the form of a rough edge around the blank or the hole.

C

2.15 *Camber* — Slight taper of a member or part as might appear looking at the edge of strip, plate or beam, usually, considered as a slight convexity over a considerable area.

2.16 *Cannelure* — A groove, especially a circular groove, around a cylindrical surface, such as a groove around a bullet for lubricant or the groove into which cartridge case is crimped.

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2.17 *Canneluring* — The rolling process in forming circular grooves around a cylindrical surface.

2.18 *Canning* — A surface forming phenomena where internal stresses and strains cause an effect such that it can be deflected by a finger pressure and return to its original position when pressure is removed.

2.19 *Closed Bevel* — Bend with bend angle of over 90°.

2.20 *Closing-in* — Forming a closed end on a tabular part.

2.21 *Coil* — A long sheet or strip of material closely wound to form a spiral ring.

2.22 *Coining* — A squeezing operation, in which metal is forced to flow to fill the shape and profile of the dies usually done in a closed die. The term is also applied to other very severe and localized coldforming operations.

2.23 *Cold Working* — Changing the shape of a metal piece below its recrystallization temperature by forces which cause plastic flow without rupturing. In general the strength and hardness are increased by cold working while the ductility is reduced.

2.24 *Compression* — Stress to which a part may be subjected which tends to squeeze or compress it.

2.25 *Cup* — Any hollow sheet metal or shell closed at one end.

2.26 *Cupping* — First operation in deep drawing or ironing, usually done without blank holding.

2.27 *Crimping* — A forming operation used to set-down or close-in a seam.

2.28 *Curling (also called False Wiring)* — Forming an edge or circular cross-section along a sheet or along the end of a shell or tube, either inside or outside, for example, curled edges on cans, pots and pans.

D

2.29 *Deburring* — Process of removing burrs and smoothing edges.

2.30 *Deep Drawing* — The drawing of deeply recessed parts from sheet material through plastic flow of the material, when the depth of the recess equals or exceeds the minimum part-width.

2.31 *Die Marks* — The undesirable marks appearing on a stamping due to defects in die.

2.32 *Dimpling* — Localized indent forming of sheet metal.

2.33 *Dinking* — Process of cutting out any shape of non-metallic material like, leather, paper, rubber, etc, and light gauge soft metal like aluminium by means of hollow punch with knife like edges acting against a wooden or fibre block.

2.34 *Dishing* — Forming a large radiused concave surface in a part without intentional change in thickness.

2.35 *Distortion* — Any deviation from a desired contour or shape.

2.36 *Drawability* — A measure of feasible deformation of a blank during drawing process; can be expressed as a percentage of reduction in diameter of a blank when it is drawn to a shell of maximum practical depth.

2.37 *Draw Bead* — Narrow rib like projections on draw-ring or blank holder surfaces to control the flow of metal in press working.

2.38 *Draw Bench Forming* — Forming straight section by pulling through profiled rolls or dies mounted on draw bench.

2.39 *Drawing* — Process of producing a cup like form from a sheet metal with or without holding it firmly to prevent formation or wrinkles while the punch travel gives required shape.

2.40 *Ductility* — That property or characteristic of a material which permits plastic working in tension without rupture as in drawing or stretching, and is measured in a general way by the elongation and reduction in area of a test piece when pulled in a tensile testing machine.

E

2.41 *Earing* — The formation of ears or scalloped edges in the form of waves around the top of drawn shell resulting from directional differences in the plastic working properties (anisotropy) of rolled metal.

2.42 *Ejecting* — Removing the part from press tool by mechanical or other means.

2.43 *Elasticity* — That property or characteristic of a material which resists deformation and thereby causes it to return to its original shape and size when deforming forces are removed.

2.44 *Embossing* — A process for producing relatively shallow sunken or raised designs in sheet material by means of male or female dies, theoretically with no change in thickness. Heavy embossing and coining are similar operation.

F

2.45 *Fine Blanking* — Blanking with considerably small tool clearances and with modified tool design (such as incorporation of V-ring) which reduces fracture and produces a clean, smooth, square cut surface.

2.46 *Fixture* — A tool or device for holding and accurately positioning a piece or part on machine tool or other processing machine.

2.47 *Flange* — A projecting rim or edge of a part usually narrow and of approximate constant width for stiffening or fastening.

2.48 *Flanging* — Forming flanges around the periphery of workpiece.

2.49 *Flaring* — Forming a flange on a tubular part.

2.50 *Flattening* — Removing irregularities of metal surface by a variety of methods, rolling and/or roller levelling of stock or diamond serration blocks or by restriking.

2.51 *Fluting* — Forming longitudinal recesses in a cylindrical part.

2.52 *Fold* — A defect in sheet metal or a formed part when metal layer folds one over the other.

2.53 *Forming* — Any change in the shape of a metal piece brought about by plastic deformation and without metal removal.

G

2.54 *Grain Formation in Sheets* — Direction of grain formation in sheets. In the direction that the sheet or strip is rolled, the sheet will have greater tensile strength and ductility than those across the rolling direction.

2.55 *Grooving* — Forming a depression on inside of a tubular part.

H

2.56 *Hemming* — An operation which folds the edge of the part back on itself. The edge may or may not be completely flattened to form a closed hem.

2.57 *Hole Flanging* — Drawing out a flange or rim around a hole in the bottom or side of shell or in a flat plate.

2.58 *Hot Working* — Metal working operation at sufficiently high temperature above recrystallization temperature to prevent distinct strain hardening. In hot working recovery and recrystallization occur simultaneously along with deformation.

I

2.59 *Indenting* — Forming of recesses of depressions of appreciable size and with fairly square walls in the surface of any material by cold forging or embossing process.

2.60 *Ironing* — Press operation of reducing the wall thickness of a shell while retaining the original thickness of bottom, and reducing the inside diameter by only a small amount.

J

2.61 *Joggle* — An offset (usually with parallel surfaces) in the surface of a sheet or part.

L

2.62 *Lancing (Louvring)* — Slitting and forming a pocket shaped opening in a part without producing a detached slug.

M

2.63 *Malleability* — That property or characteristic of metal which permits plastic deformation in compression without rupture.

N

2.64 *Necking* — Reducing the diameter of a portion of length of a cylindrical shell or tube.

2.65 *Nibbling* — Continuous cutting of a sheet metal by a rapidly reciprocating punch which makes numerous small cuts.

2.66 *Noising* — Forming a curved portion with reduced diameters at the end of tubular part.

2.67 *Notching* — Cutting out of various shapes from one or two edges of a strip, blank or sheet.

O

2.68 *Offsetting* — Two bending operations in one stroke of machine, but forming the workpiece in opposite direction such as to form offset shape.

2.69 *Open Bevel* — Bend with bend angle less than 90°.

2.70 *Orange Peel* — It is a type of defect seen on drawn components. The grain structure of metal changes due to stretch of metal and therefore, the original surface finish is lost and the surface looks like surface of an orange. Orange peel surfaces are observed on sheets having large grain sizes.

2.71 *Over Bending* — Bending metal more than that required in the finished piece so as to compensate for spring back.

P

2.72 *Parting* — An operation usually performed to produce two or more parts from one common stamping.

2.73 *Penetration* — The depth to which a punch must sink below the surface of a sheet without shear in order to effect complete rupture is called penetration.

2.74 *Perforating* — Piercing of many holes, usually identical and arranged in regular pattern, in a sheet, blank or previously formed part. The holes are usually round but may be of any other shape.

2.75 *Piercing* — Cutting openings, such as holes or slots in stock, such that the slug or piece produced is scrap.

2.76 *Planchet* — A disc of metal with edges milled ready for coining.

2.77 *Planishing* — A hammering operation in which plates or parts are given a dense, smooth surface finish by a rapid succession of blows delivered by highly polished dies or hammers of planishing hammer. The term is also used for a rolling operation in which sheet metal or plates are given a final surface finishing operation.

2.78 *Plastic Flow* — The phenomenon which takes place when a substance is deformed permanently without rupture.

2.79 *Punching* — Shearing of a closed contour in sheet metal.

2.80 *Proof Stress* — The stress required to produce a certain amount of permanent set in metals which does not exhibit a specific yield point.

R

2.81 *Redrawing* — Second and following deep drawing operations in which the cup like shells are deepened and reduced in cross-sectional dimensions.

2.82 *Reeding* — The serrations (ridges and grooves) around edge of a coin formed in the die in the coining operation.

2.83 *Restriking* — A sizing of light coining operation in which compressive strains are introduced in the stamping to counteract or offset tensile strains set up in previous operations, for example, restriking is used to counteract spring-back in bending operation.

2.84 *Roll Bending* — Curving of sheets, bars and sections by means of rolls.

2.85 *Roll Forming* — Forming a strip into a straight section by means of a set of driven rolls.

2.86 *Rubber Pad Forming* — A forming process in which rubber pad forms the workpiece around a contour of punch on die. In this case either the punch or the die is replaced by rubber.

S

2.87 *Scrap* — Pieces of material which are not normally usable.

2.88 *Seam* — The fold or ridge formed at the joining line of two pieces of sheet material.

2.89 *Seaming* — The process of joining two edges of sheet material to produce a seam.

2.90 *Serrated* — Having a toothed or notched edge like a saw edge, for example, the reeding or serrated edge around the edge coin.

2.91 *Shaving* — A subsequent shearing or cutting operation by which the surface of a previously cut edge is finished or smoothened.

2.92 *Sheet* — Any material or piece of uniform thickness and of considerable length and breadth as compared to its thickness is called sheet or plate; such pieces under 6 mm in thickness are called sheets, and 6 mm thick and over are called plates.

2.93 *Sizing* — Secondary forming or squeezing operation required to square up, set down, flatten or otherwise correct surfaces or their relations, to produce specified dimensions and tolerances.

2.94 *Slitting* — Cutting or shearing along single lines either to cut strips from sheet or to cut along lines or given length or contour in a sheet or part.

2.95 *Slug*

a) Small pieces of material (usually scrap) which are produced in piercing holes in sheet material.

b) Blanks used for extrusion operations.

2.96 *Spinning* — A method of forming sheet metal or tubing into seamless hollow cylinders, cones, hemispheres or other circular shapes by a combination of rotation and force.

2.97 *Spotting* — A process of finishing a punch or a die to match with the master by removal of high spots.

2.98 *Spring Pack* — The extent of which metal naturally tends to return to its original shape or position after undergoing a forming operation because of elasticity. This is compensated for by over bending of or a secondary operation of restriking.

2.99 *Squeezing* — Operation in which part of the metal under compression plastically flows into contours of the die, the remaining metal is unconfined and flows generally at an angle to the direction of applied force.

2.100 *Stamping*

a) A general term to denote all press working.

b) To impress lettering or designing by pressure on to the surface of a material.

2.101 *Strain* — The deformation, or change in size or shape of a body produced by stress in that body.

2.102 *Strain Hardening* — The hardening of metal when it is subjected to plastic flow (strain) in cold working.

2.103 *Stress* — The internal force per unit area of the cross-section of the body set up inside a body by external applied force or forces.

2.104 *Stress Cracking* — Cracking of part by retained residual stress from cold forming, heat treating or rapid cooling.

2.105 *Stress Relieving* — Process which is applied primarily for the purpose of reducing residual stresses.

2.106 *Stretch Forming* — Forming of sheet, bars and rolled or extruded sections over a form block of the required shape while the workpiece is held in tension.

2.107 *Stretch Levelling* — A stretching process applied to sheet metal for producing a very flat surface with smooth finish. The ends of sheet are gripped between jaws, and uniform tensile stresses are set up in the metal to produce slight plastic flow.

2.108 *Stripping* — Process of removing workpiece from punch to die.

T

2.109 *Tapering* — A swaging or reducing operation in which the metal is elongated in compression for producing conical surfaces on tubular parts.

2.110 *Template* — A flat pattern or guide usually paper or sheet metal to be followed in laying out and fabricating a part of similar shape, contour or other characteristics.

2.111 *Trimming* — A secondary cutting or shearing operation on previously formed, drawn or forged parts in which the surplus metal or irregular outline or edge is sheared off to form designed shape and size.

2.112 *Trimming Allowance* — Excess material beyond or outside of a finished part which is necessary on account of variations or irregularities in material and processing. This is trimmed off in a secondary or finishing operation.

U

2.113 *Ultimate Strength* — The ultimate strength of a material is the maximum stress to which the material can be subjected before or at rupture.

W

2.114 *Waviness* — A surface defect in a drawn part which looks like a wave on water.

2.115 *Wiper Forming* — Method of curving sections and tubing over a form block in which this form block is rotated relative to wiper block.

2.116 *Wiring* — Formation of a bead along the edge of a sheet or around the edge of a shell or tube with a rod or wire inserted within the curl for stiffening the edge.

2.117 *Work*

a) Any material, parts or pieces that are being processed or handled to or from processing, and

b) Used in mechanics, it is force multiplied by distance travelled by point of application of force in the direction of force.

2.118 *Wrinkling* — Formation of wavy condition or wrinkles on workpiece due to buckling which takes place when unbalanced circumferential compressive stresses are set up in the flange during drawing operation.

Y

2.119 *Yield Point* — The lowest stress to which a material or body can be subjected, and at which strain increase without any appreciable or proportionate increase in stress.

EXPLANATORY NOTE

This standard was first published in 1973 to cater the needs of metal forming industry for standardization of terms used in connection with metal forming machines, processes, relating tools and their components in order to assist the correct interpretation of common terms used in this field.

The committee responsible for formulation of this standard decided to revise the same based upon experience gained in implementing this standard over so many years. In the present revision, some terms have been deleted and some additional terms have been included.

This standard forms Part 3 of the glossary of terms. The following other two parts have also been revised :

Part 1 Metal forming tools, and

Part 2 Metal forming machines relating to sheet metals.

In preparing this standard assistance has been derived from :

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Metal Handbook. Vol 4. Forming. American Society of Metals, USA.

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